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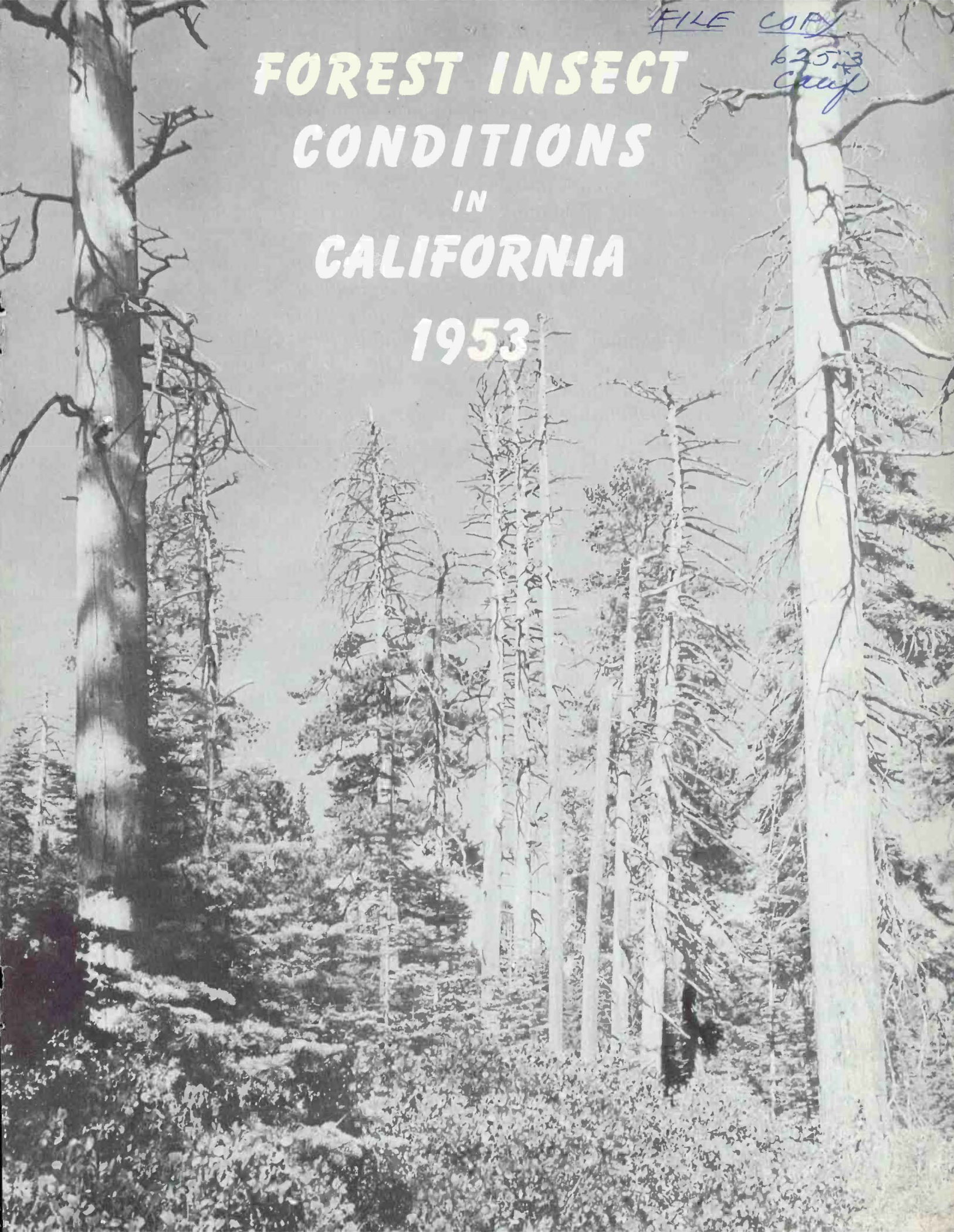
FOREST INSECT CONDITIONS IN CALIFORNIA 1953



The California Forest Pest Control Action Council is composed of representatives of the following organizations:

California Forest Protective Association

State of California Bureau of Entomology

State of California Division of Beaches and Parks

State of California Division of Forestry

U. S. Bureau of Entomology and Plant Quarantine

U. S. Bureau of Indian Affairs

U. S. Bureau of Plant Industry, Soils and Agricultural Engineering

U. S. Forest Service

U. S. National Park Service

University of California

Western Pine Association

FOREST INSECT CONDITIONS IN CALIFORNIA

As Revealed by Surveys During 1953

Official Report of the

CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL

Sacramento January 1954

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STATEWIDE CONDITIONS IN BRIEF

Losses caused by tree-killing insects were slightly lower this year. Even so, the stumpage value of insect-killed timber was approximately 17 million dollars. While both natural and man-made control accounted for tremendous reductions of damage, new outbreaks in other areas largely offset control achievements.

Sub-normal temperatures for the months of April through August exerted considerable effect upon this year's infestations. Such events as the emergence of overwintering Jeffrey pine beetle broods and the flight of lodgepole needle miner moths were delayed approximately one-and-one-half months. The general tendency for bark beetles to emerge later this year resulted in fewer generations and consequently less summer tree-killing. Possibly, much heavier damage will be evident next spring when trees that were attacked late in the season begin to fade.

Highlights of forest insect conditions in California in 1953 are presented below. A more detailed account of the status of each of the major forest insect pests appears on pages 6 and 7.

1. Thousands of acres of lodgepole pine in Yosemite National Park experienced a wholesale outbreak of the lodgepole needle miner equal to that which played a part in the creation of the famous ghost forests thirty years ago. A portion of the 45,000 infested acres was sprayed by airplane with DDT in September in an effort to control the outbreak in the most valuable part of the infested area. There is strong evidence that an outbreak of the mountain pine beetle is getting underway in the defoliated lodgepole pine stands.

2. The pine stands in southern California continued to suffer severe killing by the California flatheaded borer. Damage caused by other forest insects in this area has declined remarkably since last year. This is due in part to the large amount of control work that has been performed there for several years. A new approach to bark beetle control in this area, namely the prevention of tree-killing by sanitation-salvage cutting has been undertaken recently. In certain stands where this method appears to hold promise small volumes of highly susceptible trees have been logged.

3. The Jeffrey pine beetle along the north boundary of Lassen Volcanic National Park has developed into a serious outbreak. This is the only major bark beetle which is found solely in California. Recently, its explosive behavior in several eastside stands has given it increased importance.

4. The Douglas-fir beetle increased in numbers in the north coast region, but tends to be confined to areas recently logged and in windthrown material. The current nature of loss caused by this insect in Oregon suggests that damage in California may become severe.

5. The mountain pine beetle, generally more active this year in westside Sierra stands, is epidemic at Crystal Bay, Lake Tahoe, Nevada and Conness Basin, Yosemite National Park. The infestation at Crystal Bay occurs in second-growth ponderosa pine, while the Conness Basin outbreak is in lodgepole pine which has been defoliated by the lodgepole needle miner.

6. Two of our most common bark beetles, the western pine beetle and the fir engraver, which ordinarily cause heavy tree mortality, were curiously absent this summer in many areas where each had been responsible for heavy loss last year. However, there are numerous indications that the overwintering generation of the western pine beetle will be substantially larger than was indicated by the small amount of summer damage.

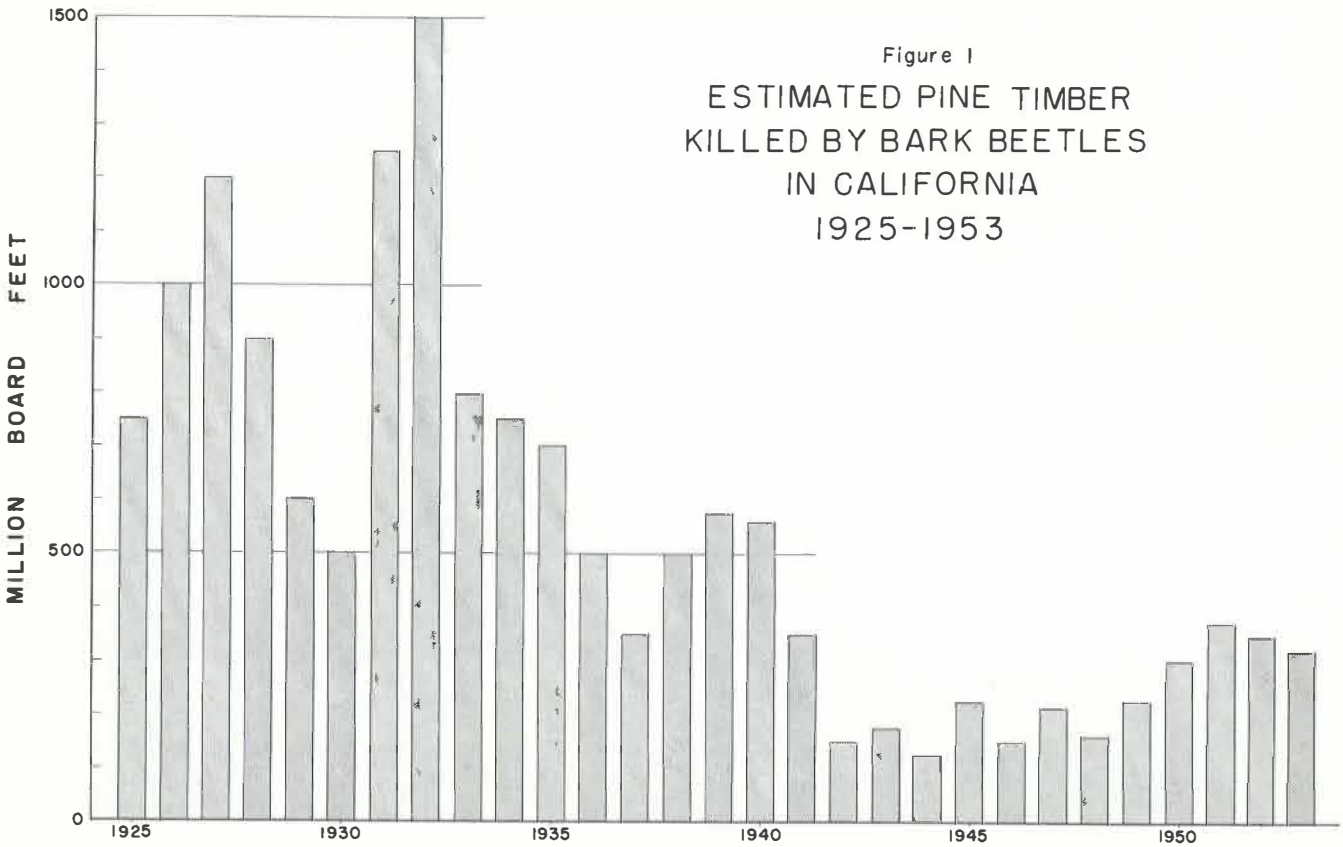

Figure 1

ESTIMATED PINE TIMBER
KILLED BY BARK BEETLES
IN CALIFORNIA
1925-1953

SURVEYS OF FOREST INSECT DAMAGE

In California, forest insect activity is evaluated by measuring the number and volume of trees killed by insects. Although population surveys in which relative numbers of insects are determined hold promise as a future means of predicting outbreaks, they are not possible at present. Basically, loss surveys involve either the detection or appraisal of damage.

DETECTION SURVEYS

Detecting the presence of infestations while they are small is a fundamental requirement, if control measures are to be applied at the earliest moment before conditions get out of hand. Due to the fluctuating nature of insect activity a fresh examination of the forest is required each year. In fact, some bark beetles produce several generations in one year, permitting them to amass great numbers in a matter of months. This results in the need for continuous observation of certain stands. Considering that approximately 16 million acres of forest land are subject to depredation by insects, it is a difficult job to provide adequate survey coverage.

The Berkeley Forest Insect Laboratory integrates the survey program in California. In addition to conducting systematic surveys with its own personnel, the Laboratory receives information submitted by a large number of cooperating private, state and federal agencies. The cooperative detection survey depends upon the ability of participating individuals to successfully uncover new infestations in their working areas. Where advisable, entomologists are then dispatched to the scene in order to evaluate the damage and to recommend for or against control action.

This cooperative approach to the detection of forest insect outbreaks was inaugurated in 1951 and has proved very successful. This system has the advantages of instilling greater interest of forest managers in their insect problems and making more effective the efforts of available entomologists. In order to facilitate and standardize the submission of detection survey findings a form (Figure 2) has been prepared and distributed to participants in the program. Those desiring to help in this work are encouraged to request details and field forms from the Berkeley Forest Insect Laboratory, 29 Forestry Building, U. C., Berkeley, California.

APPRAISAL SURVEYS

When infestations require control action, information more detailed than that obtained by detection surveys is needed. Such information is obtained by cruising or appraising the infested area. Normally, only a fraction of the total area is cruised. Either circular plots or sample strips are used, their number depending upon the size of the infested area and the amount and distribution of loss.

DRAIN SURVEYS

While the detection and appraisal surveys tell us the nature of loss in some of the larger outbreaks they fail to provide estimates of total insect-caused losses throughout the State. This must be done by another means. Permanent sample plots on which every tree is identified by number seem to answer the needs of drain surveys. The plots must be visited at least every two years at which time the insect-killed trees are recorded. Losses from all sample plots are then multiplied by a suitable factor in order to arrive at an estimate of total loss for the State. In this way we are able to evaluate the importance of this drain on our economy. We also learn which insects are most destructive from year to year, and can direct research on control methods where it is most needed.

It has been suggested that 460 two-and-one-half acre sample plots well scattered over the State would provide an adequate measure of total drain. A recent canvass of timber managers indicates that there are more than enough plots of various sizes already in existence which can be incorporated into the drain survey. It seems evident that here is another instance where cooperative endeavor by government and industry will eventually result in better estimates of insect damage.

Figure 2

FIELD REPORT OF FOREST INSECT DAMAGE

(See Instructions On Back)

1. Date _____
2. Location _____
3. Tree Spp. _____
4. Type of Damage _____
5. Insect Responsible _____
6. Age and Size of Trees _____
7. Single Trees _____, Groups (no. per group?) _____
8. Acreage _____, No. Affected per Acre _____
9. Conditions Associated with Damage _____
10. Number Years Infestation Active _____
11. Now Increasing _____ or Decreasing _____
12. Other Information and Remarks _____

Name and Address of Sender

STATUS OF THE MAJOR FOREST INSECT PESTS DURING 1953

1. Western pine beetle (Dendroctonus brevicomis). Damage to ponderosa pine caused by this bark beetle usually is at a relatively high level. However, summer broods this year killed far fewer trees than was anticipated on the basis of steadily increasing losses during the past few years. Losses in northeastern California and in the westside Sierra-Nevada were especially low, but active outbreaks were found in the north coast and in southern California.

2. Jeffrey pine beetle (Dendroctonus jeffreyi). Epidemic outbreaks by this insect were encountered in several new areas of northern California. The worst damage is located along the north boundary of Lassen Volcanic National Park where large-scale control work has already been put into effect. Most attempts to suppress outbreaks of this beetle are being made through logging of infested trees. The harvesting of mature trees in the Thompson Peak area, Plumas County, where a serious outbreak occurred last year, is planned in the near future, and will provide long-term protection from further damage by this insect.

3. Mountain pine beetle (Dendroctonus monticolae). Loss in second-growth ponderosa pine continued at a rather high rate at Crystal Bay, Lake Tahoe, Nevada. Second-growth sugar pine stands in parts of the westside Sierra-Nevada also suffered moderate to heavy killing. Infestations in old growth sugar pine increased considerably over recent years. An outbreak in lodgepole pine in Conness Basin, Yosemite National Park indicates that loss will increase as the beetles build up in trees severely defoliated by the lodgepole needle miner.

4. Douglas-fir beetle (Dendroctonus pseudotsugae). Tree-killing in northern westside Sierra areas has subsided following a two-year period of accelerated loss. Loss in the north coast subregion appears to be increasing slowly. The activity is related to wind and logging damage. Experience in Oregon indicates that the beetle can become suddenly epidemic where its development is favored by suitable breeding material.

5. Fir engraver (Scolytus ventralis). A spectacular decline in the amount of fir killing occurred following a very heavy general outbreak last year. With few exceptions the situation has returned to normal. There is no information as to the cause for this sudden change.

6. Pine engravers (Ips spp.). Heavy precipitation this spring and generally light wind breakage in pine stands combined to minimize damage by these insects in most areas. Several exceptions prevail in the westside Sierra and Coast Range. Damage is most severe in Mendocino County where numerous groups of ponderosa pine have been killed by these beetles, attacking in association with the western pine beetle.

7. California flatheaded borer (Melanophila californica). This flatheaded borer continues to be the major cause of Jeffrey pine loss in southern California. Infestations also are present in Mono County. The activities of this insect are such that control is difficult. Its young are capable of living in healthy trees for extended periods but appear to kill their host only when it becomes weakened by unfavorable climatic changes, fungi or other agents. Attempts to control its numbers are being undertaken by removal of high risk trees and direct treatment of infested trees.

8. Lodgepole needle miner (Recurvaria milleri). This moth previously has caused great damage to lodgepole pine at elevations between 7,000 and 9,000 feet in Yosemite National Park. The ghost forests in the vicinity of Tenaya Lake and Tuolumne Meadows

were created by a combination of defoliation by the needle miner and subsequent attacks by the mountain pine beetle some 30 years ago. A recent outbreak of the needle miner now covers 45,000 acres of lodgepole pine and constitutes the most spectacular current forest insect infestation in California. Aside from prospective tree killing by the needle miner, the threat of a mountain pine beetle buildup in the defoliated trees is a real one, constituting a hazard to the entire area. Control against both of these insects has become necessary. Late in the summer, DDT spray was applied by airplane to 11,000 acres of infested lodgepole pine in an attempt to control the needle miner. The needle miner also is active in Sequoia-Kings Canyon National Park.

9. Sawflies (Neodiprion spp.). Several areas of defoliation by these insects were observed this year. White and red fir were the principal hosts attacked. Considerable economic damage resulted from sawfly feeding on Christmas tree stock in the Rubicon River area of Placer County. Last year's large outbreak in Plumas County was the subject of intensive biological studies this summer. An aerial spraying test, in which DDT was used showed that this method could be used with good success as a means of control. However, late in the season, a native virus destroyed most of the sawfly larvae, bringing an abrupt end to the infestation. Similar mortality was observed in another infestation located near Crane Flat in Yosemite National Park.

10. Other important insects. Although this was not a good cone year, cone and seed insects destroyed much seed, especially that of sugar pine in Shasta County. The spruce budworm (Choristoneura fumiferana) was once again found on white fir and lodgepole pine in the north Warner Mountains of Modoc County, but damage continues to be very light. The reproduction weevil (Cylindrocopturus eatoni) caused a limited amount of killing of young pines in several plantations in Shasta and Siskiyou Counties. Activity of the red turpentine beetle (Dendroctonus valens), was fairly restricted and most injury was located in southern California. Twig beetles (Pityophthorus spp.) were unusually abundant and caused a large amount of twig and top killing of ponderosa pine in westside Sierra and northeastern California stands. The resin midge (Retinodiplosis spp.), which caused severe injury to natural second-growth and planted ponderosa pine in Eldorado and Shasta Counties died out due to unknown causes. A needle sheath miner (Zelleria haimbachi), found last year on young ponderosa pine in the Sugar Hill plantation, Modoc County, persisted this year but caused only light defoliation. A light infestation of this insect was also found on pines at the Institute of Forest Genetics, Eldorado County.

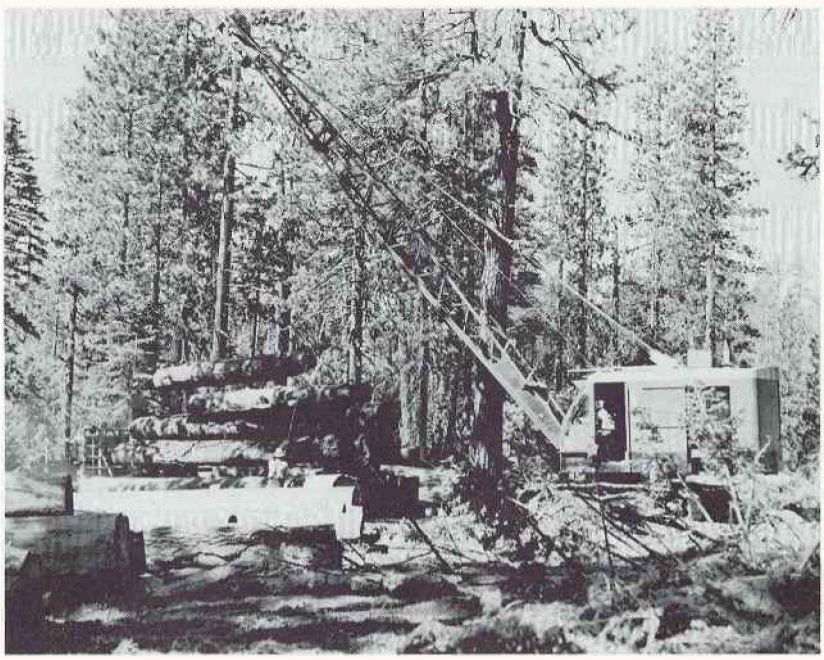

Figure 3. Salvage-logging of infested trees to control the Jeffrey pine beetle. Plumas County, 1953.

THE CONTROL PROGRAM ENDORSED FOR 1954

On November 5, 1953, the California Forest Pest Control Action Council convened in Sacramento to review the results of control action following recommendations made in 1952, and to consider control needs for 1954. The Council is made up of individuals interested in California's forest insect problems. Surveys and control of forest insects are for the most part performed jointly by the groups represented on the Council. Because of its part in formulating the annual control program, the Council has assumed the sponsorship of the Annual Forest Insect Conditions Report.

During the meeting, 61 infestations were described, as determined from cooperative detection surveys. Table 1 is a summary of control projects which are endorsed by the Council. Thirteen others were classed as needing additional information before the course of action could be determined. An additional 20 infestations were declared not serious, and continued surveillance was recommended.

The first project listed in Table 1 is the only one involving a forest which is valued primarily for commercial wood production. This does not necessarily indicate that losses are lower in commercial stands but rather that more loss can be tolerated there than in recreation forests.

The second project is designed to protect an experimental area where studies in tree genetics are conducted. The remaining projects are located in recreation forests. Fifty percent of these are in southern California where recreational use greatly exceeds values for commercial wood production. Recent control operations have resulted in such a marked reduction of loss in this area that the bulk of current control needs are of a maintenance nature. Maintenance control implies that although the main force of the infestations is disrupted, it is necessary to maintain reduced control efforts in order to prevent a recurrence of outbreaks. Generally, maintenance control is continued throughout the period in which various factors favor such buildups.

Somewhat hidden from view are the efforts of private and public forest owners in stemming and preventing losses in commercial stands which make up most of our forest resource. For the most part, these efforts are done without large expenditures. In fact, they normally result in net cash income from sale of logs. They are often undertaken on the sole initiative of the forest managers concerned. There are two types of cutting involved in operations of this sort. One type is salvage-logging of dead trees. Much of the effort goes toward salvage of trees after the bark beetles have left them. No control benefits are derived by this procedure but a current trend in the case of the larger infestations is to do the logging in the fall or spring while insect broods are still in the trees. This protects the remaining living trees. Project number one in Table 1 is an excellent illustration of this. In this instance, all infested trees were located during the fall and their removal was scheduled to be completed well before emergence of the beetles. As a means of gaining maximum control benefits, unmerchantable infested trees will be sprayed with insecticide.

Another method of cutting to reduce losses in commercial stands is through sanitation-salvage logging. This method removes a small percentage of the living trees which are highly susceptible to bark beetle attack. Their removal leaves only the trees which are most able to resist or escape infestation, and has long-lasting benefits not attained by any other control method. The application of sanitation-salvage logging since 1937 has helped greatly to prevent recurrences of such great outbreaks as those experienced in northeastern California in the early 1930's. National Forests in northeastern California are operating under a planned procedure of removing high risk trees from their

forest land by this method before harvest cuttings are made. Likewise, large industrial forest companies in that part of the State have recognized the sound economics of this procedure and have applied it to their higher insect-hazard areas. Wherever applied, these operations have had a greater influence in reducing losses than has direct control. This is doubly significant when it is realized that the logged high risk trees sell for figures equivalent to regular timber sales of green trees.

The economic aspects and long-lasting benefits attendant to sanitation-salvage logging have led to its experimental application in a recreational forest area in southern California. The area selected as most nearly like northeastern California, where the method was developed, is Barton Flats, San Bernardino County (Project Number 12, Table 1). It is hoped that this principle will apply equally well there and that it will eventually help reduce the needs for direct control in that region.

Figure 4. Lodgepole pine ghost forest in Yosemite National Park as it looked in 1924 (left) and 1953 (right). Large trees were defoliated in 1919, then killed by the mountain pine beetle in 1920. Young trees have grown in amongst snags only to become heavily infested with needleminer 33 years later.

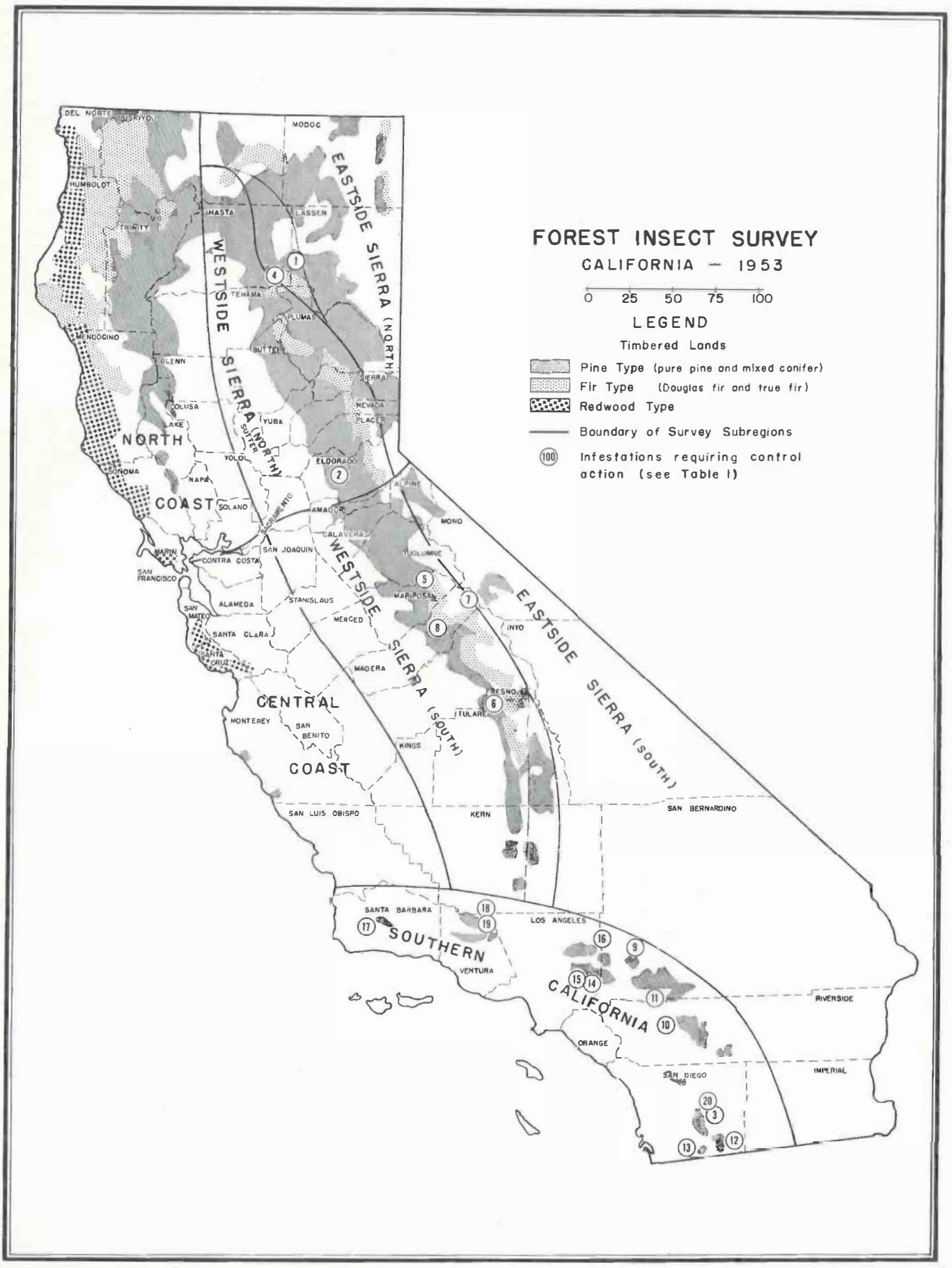
FOREST INSECT SURVEY
CALIFORNIA — 1953
0 25 50 75 100
LEGEND
Timbered Lands
Pine Type (pure pine and mixed conifer)
Fir Type (Douglas fir and true fir)
Redwood Type
Boundary of Survey Subregions
(100) Infestations requiring control action (see Table I)
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
MENDOCINO
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
COLUSA
NEVADA
LAKE
YUBA
PLACER
SUTTER
YOLO
EL DORADO
SONOMA
NAPA
ALPINE
SOLANO
AMADOR
MONO
SACRAMENTO
CALAVERAS
MARIN
SAN JOAQUIN
TUOLUMNE
CONTRA COSTA
SAN FRANCISCO
MARIPOSA
ALAMEDA
STANISLAUS
SAN MATEO
MERCED
INYO
SANTA CLARA
SANTA CRUZ
MADERA
FRESNO
TULARE
MONTEREY
SAN BENITO
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
LOS ANGELES
VENTURA
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
NORTH COAST
CENTRAL COAST
SOUTHERN CALIFORNIA
WESTSIDE SIERRA (NORTH)
EASTSIDE SIERRA (NORTH)
WESTSIDE SIERRA (SOUTH)
EASTSIDE SIERRA (SOUTH)

TABLE 1.--CURRENT FOREST INSECT INFESTATIONS REQUIRING CONTROL ACTION

PROJECT AREA	LOCATION	INFESTED ACREAGE	INSECT SPECIES CAUSING LOSS	HOST TREES KILLED	CONTROL ACTION RECOMMENDED
			COMMERCIAL TIMBERLANDS		
(1) Lassen National Forest	Lassen and Shasta Cos.	5,000	Jeffrey pine beetle Western pine beetle	Jeffrey pine Ponderosa pine	Salvage merchantable infested trees Spray unmerchantable material with toxic oil
			EXPERIMENTAL AREAS		
(2) Institute of Forest Genetics	Eldorado Co.	500	Western pine beetle Pine engravers	Ponderosa pine	Maintenance control, fell-peel-burn, or spray with toxic oil
			STATE AND NATIONAL PARKS		
(3) Cuyamaca Rancho State Park	San Diego Co.	1,000	California flatheaded borer	Jeffrey pine	Maintenance control, spray with toxic oil
(4) Lassen Volcanic National Park	Shasta, Lassen Cos.	8,000	Jeffrey pine beetle Western pine beetle Mountain pine beetle	Jeffrey pine Ponderosa pine	Maintenance control, spray with toxic oil
(5) Yosemite National Park	Mariposa, Tuolumne Cos.	10,000	Western pine beetle Mountain pine beetle	Ponderosa pine Sugar pine	Maintenance control, spray with oil or fell-peel-burn
		45,000	Needleminer	Lodgepole pine	Aerial application of toxic oil spray, contingent upon results of 1953 test project.
		500	Mountain pine beetle	Lodgepole pine	Spray with toxic oil
(6) Sequoia-Kings Canyon National Parks	Fresno and Tulare Cos.	8,500	Western pine beetle Mountain pine beetle	Ponderosa pine Sugar pine	Maintenance control, fell-peel-burn or spray with toxic oil
			FOREST RECREATION AREAS		
(7) Reds Meadow	Inyo N. F.	700	Mountain pine beetle	Lodgepole pine	Maintenance control, spray with toxic oil
(8) Bass Lake	Madera Co.	500	Western pine beetle Pine engravers	Ponderosa pine	Maintenance control, fell-peel-burn or toxic spray
(9) Arrowhead-Crestline	San Bernardino Co.	38,000	Western pine beetle Pine engravers	Ponderosa pine Coulter pine	Maintenance control, fell-peel-burn or toxic spray, salvage if possible
(10) Idyllwild-San Jacinto	Riverside Co.	14,500	Western pine beetle Pine engravers	Ponderosa pine Coulter pine	Maintenance control, fell-peel-burn or toxic spray
Barton Flat	San Bernardino Co.	4,000	Western pine beetle Jeffrey pine beetle	Ponderosa pine Jeffrey pine	Sanitation salvage
(12) Laguna Mountain	San Diego Co.	1,500	Western pine beetle	Coulter pine	Maintenance control, fell-peel-burn or toxic spray
(13) Corte Madera	San Diego Co.	860	Western pine beetle Pine engravers California flat-headed borer	Coulter pine Jeffrey pine	Maintenance control, fell-peel-burn or toxic spray
(14) Crystal Lake	Los Angeles Co.	500	Western pine beetle Pine engravers Mountain pine beetle	Ponderosa pine Sugar pine Jeffrey pine	Maintenance control, fell-peel- or toxic spray
(15) Charlton Flats	Los Angeles Co.	3,000	Western pine beetle Pine engravers Calif. flatheaded borer	Ponderosa pine Coulter pine Jeffrey pine	Maintenance control, fell-peel-burn or toxic spray
(16) Big Pines	Los Angeles Co.	2,500	Mountain pine beetle Calif. flatheaded borer	Sugar pine Jeffrey pine	Sanitation salvage
(17) Figueroa Mountain	Santa Barbara Co.	1,200	Western pine beetle	Ponderosa pine Coulter pine	Maintenance control, fell-peel burn or toxic spray
(18) Mount Pinos	Kern Co	500	Calif. flatheaded borer	Jeffrey pine	Sanitation salvage
(19) Grade Valley	Kern Co.	2,000	Calif. flatheaded borer Scale insects	Jeffrey pine	Sanitation salvage, toxic spray
(20) Julian	San Diego Co.	2,500	Western pine beetle Pine engravers	Ponderosa pine Coulter pine	Fell-peel-burn or toxic spray

ACCOMPLISHMENTS OF RECENT CONTROL ACTION

Twenty-three control projects were proposed in the report of forest insect conditions in 1952. Nineteen projects actually materialized. In addition several infestations evidenced themselves after the 1952 report was written and were subsequently controlled.

Other less serious infestations on commercial timberland were reduced by the removal of large numbers of infested trees during the course of logging operations. An even greater area was given long-lasting protection from barkbeetles by the removal of insect-susceptible trees in addition to infested trees.

The following tables summarize the control work accomplished by private forest industry, the California Division of Forestry, California Division of Beaches and Parks, National Park Service and U. S. Forest Service. Each of these organizations was very active in the field of forest insect control this year.

TABLE 2.--VOLUME OF INSECT-KILLED OR SUSCEPTIBLE TREES REMOVED BY PRIVATE LOGGING COMPANIES DURING 1953.

	Company	Volume(M.B.M)	Tree Species	Control Method 1/
1.	Big Bear Timber Company	300	PP, JP	Sanitation-salvage
2.	Collins Pine Company	1,500	PP	Salvage, sanitation cutting
3.	Diamond Match Company	48,000	PP, SP, DF, WF	Sanitation cutting
4.	Fruit Growers Supply Company	5,875	PP	Sanitation-salvage
5.	Hannan Logging Company	2,900	PP, JP	Salvage
6.	Scott Lumber Company	1,310	PP	Salvage, sanitation-salvage
7.	Seltzer Forest Products	7,200	PP, fir	Salvage, sanitation cutting
8.	Soper-Wheeler Company	9,515	PP, SP, WF, DF	Salvage, sanitation cutting
9.	Walker Forest	11	PP, SP, WF, DF	Salvage
10.	Weyerhaeuser Timber Company	5,200	PP	Sanitation-salvage
		81,811 (Estimate 13,000 M.B.M. of this actually insect-killed)		

1/ Sanitation-salvage applies to eastside stands. "Sanitation cutting" herein refers to similar cutting in westside stands where the same effectiveness has not yet been demonstrated.

TABLE 3.- INSECT CONTROL PROJECTS ACCOMPLISHED ON STATE AND PRIVATE LAND IN 1953 UNDER THE STATE FOREST INSECT CONTROL LAW IN COOPERATION WITH TIMBERLAND OWNERS.

	Location	No. Acres	No. Trees	Insect	Host	Control Method	Cost
1.	Miami Creek, Mariposa, Madera Cos.	840	497	Dm	SP, PP	Toxic spray	$ 2,638
2.	Lake Arrowhead, San Bernardino Co.	9380*	764	Db, Dm, Ips	PP, SP, JP, CP	Toxic spray, peel-burn	19,580
3.	San Jacinto, Riverside Co.	5722*	108	Db, Ips	PP, CP	Toxic spray, peel-burn	3,105
4.	Cuyamaca State Park, San Diego Co.	600	220	Db, Ips	PP, CP	Toxic spray	6,025
			1589				$ 31,348

*Work contracted to U. S. Forest Service

TABLE 4.--INSECT CONTROL PERFORMED BY FEDERAL AGENCIES DURING 1953.

	Location	No. Acres	No. Trees	Insects	Hosts	Control Method	Cost	Income
				NATIONAL PARKS				
1.	Lassen Volcanic	6,520	195	Db, Dm, Dj, Ips	PP, SP, JP	Peel-burn, toxic spray	$ 6,239	
2.	Yosemite	11,000	---	Needleminer	LP	Aerial spray)	18,951	
		85,100	391	Db, Dm, Dj	PP, SP, JP, LP	Peel-burn, Salvage log)		
3.	Sequoia-Kings Canyon	31,660	172	Db, Dm, Dj, Ips	PP, SP, JP	Peel-burn	6,000	
			758				$31,190	
				NATIONAL FORESTS				
1.	Angeles	3,060	190	Db, Dm, Ips, FH	PP, SP, CP, JP	Toxic spray, peel-burn	$ 3,313	
2.	Cleveland	1,280	193	Db, FH	CP, JP	Toxic spray, peel-burn	3,040	
3.	Los Padres	500	54	Db	CP	Toxic spray	1,411	
4.	San Bernardino	22,769	779	Db, Dm, Dj, FH, Ips	PP, SP, CP, JP	Toxic spray, peel-burn	20,677	
5.	Stanislaus	80	---	Cone beetle	SP	Aerial spray	1,235	
6.	Inyo	700	16	Dm	LP	Toxic spray, burn	200	
7.	Sierra	1,000	339	Dm, Db, Ips	SP, PP	Toxic spray, peel-burn	5,865	
8.	Lassen	5,644	824	Db	PP	Salvage-log		$16,200
			2395				$35,741	$16,200

Key to Abbreviations Used:

Insects
Db = Western pine beetle
Dm = Mountain pine beetle
DJ = Jeffrey pine beetle
Ips = Pine engravers
FH = California flatheaded borer

Host Trees
PP = Ponderosa pine
SP = Sugar pine
LP = Lodgepole pine
JP = Jeffrey pine
CP = Coulter pine
WF = White fir
DF = Douglas fir

Figure 5. Loading insecticide into helicopter used to control sugar pine cone beetle. Tuolumne County, 1953.

Additional information concerning forest insects may be obtained by request to:

California Division of Forestry
301 State Office Building No. 1
Sacramento, California

or

Forest Insect Laboratory
29 Forestry Building
University of California
Berkeley 4, California

From

CALIFORNIA DIVISION OF FORESTRY
301 State Office Building No. 1
SACRAMENTO 14, CALIFORNIA

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